We claim:

1. A method comprising:

receiving a signal representing digitized, sampled human speech;

locating at least one speech segment within the signal;

5   locating one or more higher energy sections within each speech segment within the

signal;

locating a plurality of glottal events within each speech segment within the signal,

based on the one or more higher energy sections within each speech segment; and,

confirming the plurality of glottal events located within each speech segment within

10   the signal, including registering each of at least one of the plurality of glottal events with

adjacent glottal events.

2. The method of claim 1, wherein receiving the signal representing the digitized,

sampled human speech comprises:

recording human speech; and,

15   sampling the human speech to digitize the human speech, yielding the signal.

3. The method of claim 1, wherein locating at least one speech segment within the

signal comprises determining a start point and an end point of each speech segment.

4. The method of claim 1, wherein locating at least one speech segment within the

signal comprises determining an energy within the signal and examining the energy for

regions above a threshold, such that each region above of the threshold corresponds to a speech segment.

5. The method of claim 1, wherein locating the one or more higher energy sections within each speech segment comprises determining regions within each speech segment where an energy is at least a percentage of a peak energy within the speech segment.

6. The method of claim 1, wherein locating the plurality of glottal events within each speech segment comprises, for each speech segment:

subjecting each higher energy section within the speech segment to a linear predictive coefficient (LPC) analysis, yielding a LPC residual error signal for each higher energy section;

locating a number of largest peaks within the LPC residual error signal for each higher energy section that have a minimum separation between adjacent of the peaks; and,

locating the plurality of glottal events within the speech segment as corresponding to the number of largest peaks within the LPC residual error signal that have the minimum separation.

7. The method of claim 6, wherein subjecting each higher energy section to LPC analysis, yielding the LPC residual error signal, comprises, for each higher energy section, determining the LPC residual error signal as the square of the difference between the higher energy section and an LPC-derived model of the higher energy section.

8. The method of claim 6, wherein locating the number of largest peaks within the LPC residual error signal that have the minimum separation between adjacent of the peaks comprises, from all the largest peaks within the LPC residual error signal, removing those peaks that lack the minimum separation between adjacent of the peaks.

5   9. The method of claim 1, wherein confirming the plurality of glottal events located within each speech segment comprises, for each adjacent pair of glottal events within each speech segment:

comparing a first glottal event and a second glottal event of the adjacent pair of glottal events to determine a pair-wise distance between the first and the second glottal

10   events; and,

adjusting boundaries of at least one of the first glottal event and the second glottal event to minimize the pair-wise distance between the first and the second glottal events, maximizing similarity of the first and the second glottal events of the adjacent pair.

10. A computer-readable medium having a computer program stored thereon to perform a

15   glottal event confirmation method comprising:

for each adjacent pair of glottal events within each of a plurality of speech segments within a signal representing digitized, sampled human speech,

comparing a first glottal event and a second glottal event of the adjacent pair of glottal events to determine a pair-wise distance between the first and the second glottal

20   events; and,

adjusting boundaries of at least one of the first glottal event and the second glottal event to minimize the pair-wise distance between the first and the second glottal events,

such that the glottal event confirmation method increases accuracy of subsequently

performed speaker verification methods.

11. The medium of claim 10, wherein adjusting the boundaries of at least one of the first

glottal event and the second glottal event comprises adjusting at least one of a start point

5   and an end point of at least one of the first glottal event and the second glottal event.

12. The medium of claim 10, wherein adjusting the boundaries of at least one of the first

glottal event and the second glottal event maximizes similarity of the first and the second

glottal events.

13. The medium of claim 10, wherein the method further comprises initially locating a

10   plurality of glottal events within each speech segment within the signal.

14. The medium of claim 13, wherein locating the plurality of glottal events within each

speech segment comprises, for each speech segment:

      subjecting each of a plurality of higher energy sections within the speech segment to a

linear predictive coefficient (LPC) analysis, yielding a LPC residual error signal for each

15   higher energy section;

      locating a number of largest peaks within the LPC residual error signal for each

higher energy section that have a minimum separation between adjacent of the peaks;

      locating the plurality of glottal events within the speech segment as corresponding to

the number of largest peaks within the LPC residual error signal that have the minimum

20   separation;

removing any of the plurality of glottal events within the speech segment that have a

zero crossing rate greater than a threshold rate; and,

removing any of the plurality of glottal events within the speech segment that have a

duration outside of a threshold pitch interval range.

5   15. The medium of claim 13, wherein the method further comprises, prior to locating the

plurality of glottal events within each speech segment:

` locating the plurality of speech segments within the signal; and,

locating one or more higher energy sections within each speech segment.

16. The medium of claim 15, wherein the method further comprises, prior to locating the

10   plurality of speech segments within the signal, receiving the signal.

17. A speaker verification system comprising:

a computer-readable medium having stored thereon a plurality of first glottal events

extracted from previously recorded human speech; and,

a recording device to record further human speech and store a signal representing the

15   further human speech on the computer-readable medium; and,

a mechanism to generate a plurality of second glottal events from the signal, to

confirm the plurality of second glottal events by registering each second glottal event

with adjacent second glottal events, and to compare the plurality of second glottal events

with the plurality of first glottal events to determine whether the further human speech

20   recorded matches the previously recorded human speech.

18. The speaker verification system of claim 17, wherein accuracy of determining whether the further human speech recorded matches the previously recorded human speech is increased by the mechanism confirming the plurality of second glottal events by registering each second glottal event with adjacent second glottal events.

5   19. The speaker verification system of claim 17, wherein the mechanism is a computer program stored on the computer-readable medium.

20. A speaker verification system comprising:

means for recording human speech and for storing a signal representing the human speech on a computer-readable medium having previously stored thereon a plurality of

10   first glottal events extracted from previously recorded human speech; and,

means for generating a plurality of second glottal events from the signal, for confirming the plurality of second glottal events by registering each second glottal event with adjacent second glottal events, and for comparing the plurality of second glottal events with the plurality of first glottal events to determine whether the further human

15   speech recorded matches the previously recorded human speech.